

CLAIMS:

I claim:

- 1) A ventilated wearer-powered protective suit consisting of:
 - a. a body constructed of an impermeable, semi-permeable or permeable material capable of protecting the wearer from hazards such as particulates, pathogens, chemicals, radiation, electricity, electromagnetism, heat, liquids or physical trauma or is capable of protecting the surrounding area from hazards such as particulates and pathogens,
 - b. at least one bellows operated by the movement of the wearer to ventilate the suit's interior, with at least one pair of one-way valves to direct the flow of air.
 - c. air vents in the suit's body, to allow ventilating air to pass between the suit's interior and exterior.
- 2) A bellows described in Claim (1) that has:
 - a. at least one one-way valve, of any of the well-known designs such as a flap valve or ball valve, spring assisted, gravity assisted or mechanically assisted, in the bellows, connected to the suit's body, constructed to allow ambient air to be forced from the bellows through the suit's interior and,
 - b. at least one one-way valve, of any of the well-known designs such as a flap valve or ball valve, spring assisted, gravity assisted or mechanically assisted, in the bellows, constructed to allow ambient air to be drawn into the bellows from the ambient.
- 3) A bellows described in Claim (1) that has:
 - a. at least one one-way valve, of any of the well-known designs such as a flap valve or ball valve, spring assisted, gravity assisted or mechanically assisted, in the bellows, connected to the suit's body, constructed to allow ambient air to be drawn from the suit's interior into the bellows and,

- b. at least one one-way valve, of any of the well-known designs such as a flap valve or ball valve, spring assisted, gravity assisted or mechanically assisted, in the bellows, designed to allow air forced from the bellows to be expelled to the ambient.
- 4) One-way valves described in Claim (1) with permanently attached filtering and/or chemical absorbing elements in the valve ports to prevent harmful elements from passing through the valves to the suit's interior or to prevent foreign materials from causing valve failure,
- 5) One-way valves described in Claim (1) constructed without filtering elements in the valve ports, for use in situations not requiring filtration, such as for protection from: radiation, electricity, electromagnetism, heat, liquids or physical trauma.
- 6) One-way valves described in Claim (1) that contains replaceable particulate filtration and/or chemical absorption elements in the valve ports to prevent harmful elements from passing through the valves to the suit's interior or to prevent foreign materials from causing valve failure.
- 7) A protective suit described in Claim (1) which has remotely mounted filtering elements, attached to the valves, with a flexible hose or any other well-known connection device.
- 8) A protective suit described in Claim (1) that protects any part of the body such as, but not limited to: a suit that fully covers the body or a suit that partially covers the body, such as with uncovered hands, feet or head, or an upper body covering only, a head covering only or a lower body covering only.
- 9) A protective suit described in Claim (1) with a partial face shield or eye shield, a full face shield, or hood covering the head of the wearer, that has:
 - a. at least one air outlet port connected to the suit's interior by an extension of the suit's body, or any other well-known connection technique between the

shield and the suit's interior such as a flexible tube, to allow air to pass through the shield and the suit's interior;

b. a sight window.

10) A protective suit in claim (1) in which the air vents are placed in areas of the suit which maximize the passage of air past the wearer's body such as near the: head, hands and feet.

11) A protective suit described in Claim (1) constructed, at least partially, of a permeable or semi-permeable material that is capable of passing a sufficient quantity of air through the suit's body to reduce the vent area required in the suit or eliminate the use of air vents in the suit. The permeable material may contain chemically adsorbing materials to minimize the passage of harmful elements through the suit.

12) A protective suit described in Claim (1) in which the base of the bellows forms part of the protective suit's body.

13) A protective suit described in Claim (1) in which the bellows is constructed separately from the suit's body, with one of the one-way valves connected to the suit's interior by any well-known technique such as an extension of the suit's material or a flexible tube.

14) A protective suit described in Claim (1) in which the suit has loose fitting flexible material in the areas between the bellows and the body extremities, such as between an elbow fitted bellows and the wrists, to allow the extremities to move without affecting the bellows position.

15) A suit described in Claim (1) that has connections for the bellows that are closable or seal-able to allow removal of the bellows when it is not required while preventing ingress of harmful materials through the bellows connection ports.

- 16) A bellows described in Claim (1) that is designed to be movable to different areas of the body.
- 17) A suit described in Claim (1) that has more than one connection for the bellows, allowing the bellows to be moved to different areas of the body.
- 18) A bellows described in Claim (1) that is operated by the wearer's movement both collapsing and expanding the bellows.
- 19) A bellows described in Claim (1) which can be compressed by the wearer to expel the air and which self-expands to draw air in. The self-expansion can be performed by any of the well-known design techniques such as by incorporating compression springs or by constructing the bellows of a material that naturally regains its original shape.
- 20) A self-expanding bellows described in Claim (19) that is designed to slowly self-expand to reduce the peak air flow rates through the filters or suit.
- 21) A bellows described in Claim (1) that can be expanded by the wearer to expel air and self-collapses to expel the air. The self-collapsing can be performed by any of the well-known design techniques such as by incorporating tension springs or by constructing the bellows of a material that naturally regains its original shape.
- 22) A self-collapsing bellows described in Claim (21) that is designed to slowly self-collapse to reduce the peak air flow rate through the filter or suit.
- 23) A bellows described in Claim (2) which draws air atmospheric air through a filter and a separate air accumulator, situated between the filter and bellows, to reduce the filter's peak air flow rate and pressure drop.

24) A bellows described in Claim (3) which draws air through filtered air vents on the suit, through the suit, and through a separate air accumulator, situated between the filtered air vents and bellows, to reduce the filter's and suit's peak airflow rates and pressure drop.

25) A ventilated protective suit described in Claim (1) in which said bellows are placed in any position on the wearer's body in which innate movement of the wearer's body can expand and collapse the bellows, such as: the crotch of the elbow, the crotch of the knees, the buttocks, the crotch of the upper legs or in front of the hips.

26) A ventilated protective suit described in Claim (1) in which said bellows are placed in any position on the wearer's body that allows the wearer to operate the bellows such as a chest mounted bellows that can be collapsed by movement of the wearer's hands/arms or a back mounted bellows that can be compressed by pulling on chest mounted straps attached to the bellows.

27) A protective suit described in Claim (1) in which the bellows are of any of the well-known designs such as: a fan shaped bellows in which the corrugations meet at an apex, an longitudinally expandable corrugated tube, a rectangular bellows such as used in an accordion or any expandable and collapsible enclosed shape such as an elastic flexible tube that self expands when forces are removed from it, a bladder or a sphere.

28) A protective suit described in Claim (1) in which the bellows has a base plate to hold the bellows in place when the wearer moves, with a base plate formed to fit the shape of the wearer's body part supporting the bellows.

29) A protective suit described in Claim (1) in which the bellows are held in place by straps, of any of the well-known designs such as self-adjusting elastic straps or adjustable length straps, built into the suit's material or separate from the suit's material.

30) A protective suit described in Claim (1) in which the bellows is held above the wearers body, to allow air to pass under and around the bellow's base, using any of the

well-known techniques such as a three dimensional mesh, a double layered base or vent lines connected to open areas of the suit.

31) A protective suit described in Claim (1) in which a bladder, or bladders, with one-way valves, is placed between the upper legs to allow the bladder(s) to expand and collapse when the wearer walks.

32) A protective suit described in Claim (1) which has pockets located over the body joints, such as the elbow, opposite the bellows to orient the bellows when the joint is folded.

33) A pocket in Claim (30) made solely from the suit's material, or with addition reinforcement material in the pocket, that is either an integral part of the suit's body or separate from the suit's body, attached to the bellows by any of the well-known techniques such as with the use of straps or the suit's material.

34) A protective suit described in Claim (3) that is constructed to allow the passage of air through the suit when it collapses under the negative pressure created when air is drawn through the suit, using any well-known technique such as: stays, reinforcing loops, convolutions, three dimensional lining, such as mesh, batting, netting or tubes that allows air to pass through the suit's interior.

35) A protective suit described in Claim (1) which has more than one one-way valve element in the one-way valves, connected in series, to allow for continued operation of the valves if one of the valve elements fails open (fails to close off the reverse flow of air).

36) Bellows described in Claim (1) with more than one pair of one-way valves.

37) A suit described in Claim (1) with more than one bellows, such as a pair of bellows, one in each arm joint.

38) A protective suit described in Claim (1), in which the vents that allow air to pass through the interior of the suit, are areas that are commonly designed to be open, such as: the end of the legs and arms, the waist of a jacket, under arm vents, back vents and closures such as zippers and buttons.

39) A suit in Claim (1) constructed without filtering elements in the air vents, for use in situations not requiring air filtration such as for protection from: radiation, electricity, electromagnetism, heat, liquids or physical trauma.

40) A protective suit described in Claim (1) that contains replaceable filtration and/or chemical absorption elements in the air vents.

41) A protective suit described in Claim (1) that with permanently attached filtering and/or chemical absorbing elements in the air vents which allow ambient air to pass through the suit's interior.

42) A protective suit described in Claim (1) that with replaceable filtering and/or chemical absorbing elements in the air vents which allow ambient air to pass through the suit's interior.

43) Air vents in the suit's body described in Claim (1) that are closable or seal-able enabling the vents to be closed when they are not required.

44) A protective suit described in Claim (1) in which the air vents are shielded to prevent entry of liquids such as rain or chemicals.

45) A protective described suit in Claim (1) that uses any of the well-known sources of breathable air such as: a protective breathing mask with permanent or replaceable filtering elements, a protective breathing mask with an external source of air such as compressed bottled air or air supplied by an attached line.

46) A protective described suit in Claim (1) that uses a breathing mask with dual one-way valves that draws air from, or forces air through, the protective suit such as that described in the co-pending patent specification submitted by Robert B. Steinert, Customer Number 37498.